2.6 INITIAL SETUP

Place the TM 262™ Auto Tymp™ on a stable counter or table where it will subsequently be used, and near a properly grounded wall outlet. Attach accessories to their appropriately-labled connectors on the rear panel of the TM 262 (see Figure 2-9).

Locate the POWER switch on the rear panel of the TM 262 and move the switch to the ON (|) position. Note that the lamp (F1) on the front panel is illuminated, indicating the TM 262 is receiving power. The TM 262 symbol will then appear on the display along with a listing of the revision number for the Tymp/Reflex and Audiometry (if purchased) software. Next, the display will default to the Tymp/Reflex mode and the probe's green lamp will begin to blink, indicating that the TM 262 is ready to begin a test. If both the green and yellow lamps are illuminated at the same time, either the probe is occluded or the tymp/reflex software did not properly initialize. Simply move the power switch to the OFF (⏻) position, inspect the probe tip for any signs of an occlusion, and reposition the power switch to ON (|). If both green and yellow lamps are still illuminated and you are certain that the probe is not occluded, contact the Welch Allyn Technical Service Department (see page 55). In the meantime, it is still possible to select the Audiometry mode (if purchased).

Allow the instrument to warm-up for about five minutes before conducting a test. This allows the electronic circuits to stabilize prior to use. If the storage temperature is lower than the room temperature, allow some additional time for the instrument to reach room temperature.

Warning

The TM 262 is designed to be used with a hospital grade outlet. Injury to personnel or damage to equipment can result when a three-prong to two-prong adapter is connected between the TM 262 power plug and an AC outlet or extension cord. Additionally, those TM 262 Auto Tymps that are equipped with power transformers use a specific transformer (8000-0260, 8000-0261 or 8000-0262) which should not be interchanged with any other transformer or supply. The TM 262 is a specifically-calibrated device and the periodic service and adjustments which the instrument may require should be done ***only by an authorized Welch Allyn service technician.***

2.6.1 Loading The Paper

Remove the printer cover (see Fig. 2-3 for location) by placing your fingers along the back edge of the printer and pulling upward on the cover. Cut the printer paper so that the leading edge of paper is straight across. Place the roll of paper inside the paper well so that the paper will unroll from the lower surface. See paper loading label for additional help (Figure 2-11).

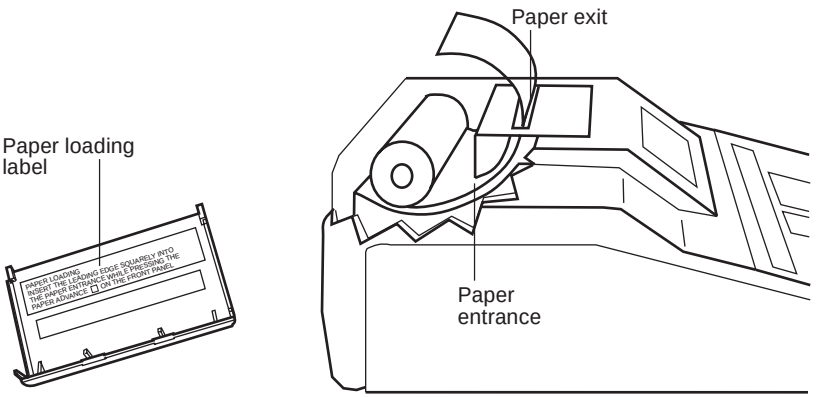

Paper exit
Paper loading label
PAPER LOADING
INSERT THE LEADING EDGE SQUARELY INTO THE PAPER ENTRANCE WHILE PRESSING THE PAPER ADVANCE ⊡ ON THE FRONT PANEL
Paper entrance

FIGURE 2-11: Paper Loading

Position the leading edge of the paper roll into the paper entrance while pressing the PAPER ADVANCE button. The paper will begin to appear out of the printer mechanism. Continue to advance the paper so that a section of paper is long enough to pass through the printer cover once it is repositioned over the printer.

2.6.2 Paper Storage

The TM 262™ Auto Tymp™ utilizes a thermal printer, which requires a heat-sensitive paper to create an image. For maximum paper life, any spare rolls of paper should be stored as follows:

1) Store in the dark, i.e., in a drawer or cabinet
2) Do not store above 77°F (25°C)
3) Store at less than 65% relative humidity

The above recommendations are for the maximum paper life (greater than five years). Storing your TM 262 thermal paper at high temperatures or high humidity levels will only shorten the total paper life.

2.7 PRETEST TYMPANOMETRY CHECKS

For your convenience, a test cavity is provided with your TM 262™ Auto Tymp™. This test cavity enables you to quickly verify the proper calibration of your unit. Welch Allyn, Inc. strongly recommends that you make this quick check a part of your daily routine.

2.7.1 Calibration

To initiate the quick check, select the Tymp only (TYMP) mode and insert the probe **(without a tip on it)** into the 0.5 cm^3 opening on the test cavity. See Figure 2-12.

NOTE

Since the TM 262 is designed to start automatically, it is important that the probe is inserted as quickly and as smoothly as possible. During the calibration check, the probe must be held carefully and without movement. Do not place the probe on the same counter as the instrument or any moving object during this check, as mechanical noise will be picked up by the probe and interfere with the calibration check.

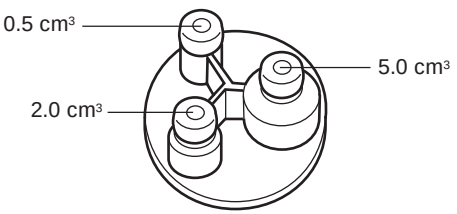


FIGURE 2-12: Test Cavity

The calibration check will start automatically if the probe has been inserted into the cavity properly. This is confirmed by the green lamp changing from blinking to a steady condition. If the orange lamp is illuminated, the probe is not properly positioned within the cavity so that a large pressure leak exists. If the yellow lamp is illuminated, the probe tip has been occluded. In either case, remove the probe and wait for the blinking green lamp. Insert the probe once again. Clean the probe tip if necessary (see Section 3.2).

When the test sequence is completed, the green lamp on the probe is no longer illuminated. Remove the probe from the test cavity and note that the green lamp is blinking once again. The display will indicate a flat line on the tympanogram along with the value of the test cavity next to the letters ECV (ear canal volume), i.e., 0.5. The letters NP will appear next to the labels cm^3 and daPa and three dashed lines will appear next to the letters GR (gradient). Since the test cavity is a hard-walled cavity, the tympanogram should be a flat line, indicating that there is no mobility in the system. The TM 262™ Auto Tymp™ places the letters NP next to the cm^3 and daPa headers to indicate that there is no peak compliance and, therefore, no peak pressure can be determined during the quick check. Also, since there is no compliance peak detected, it is not possible to calculate a gradient. Therefore, the TM 262 displays the dashed lines when a gradient calculation isn't possible.

Using the same sequence, place the probe in the test-cavity opening labelled 2.0 cm^3. Note that the display looks the same as with the 0.5 cm^3 measurement, except for the value placed next to the letters ECV (2.0). If you wish, the same sequence can be followed with the 5.0 cm^3 opening on the test cavity. To keep a record of this test-cavity-calibration check, simply press the PRINT ALL button on the front panel of the TM 262.

2.7.2 Altitude Adjustment

Since sound pressure will vary with altitude and barometric pressure, some variation from the 0.5, 2.0 and 5.0 cm^3 readings may be observed. Your TM 262 is carefully calibrated at our factory, which is at approximately 250 feet above sea level. If you are located at an elevation of 1000 feet or higher, your instrument may need to be recalibrated to account for your elevation. It is not necessary to recalibrate for barometric pressure changes on a daily basis. Just keep in mind that a change in barometric pressure (i.e., from low to high or high to low) will slightly affect the test-cavity readings.

The altitude calibration adjustment allows for "corrections" to the Ear Canal Volume (ECV) measurement and test cavity volume measurement for variations due to altitude. Because the TM 262 is a pressure-sensitive device which makes measurements relative to ambient air pressure, changes in air pressure due to weather or altitude will affect the Ear Canal Volume (ECV) read-out of the instrument. The slight pressure change resulting from changing weather conditions will usually yield volume read-outs within ±0.1 cm^3 of the expected cavity value; however, pressure changes due to altitude can shift these cavity values by as much as 30%. **These changes in pressure do not affect the accuracy of the compliance measurement system in any way.** But, many instrument operators prefer that their equipment give ECV values as they would appear at sea level. The altitude calibration mode allows the operator to adjust his/her Auto Tymp without the services of a qualified Welch Allyn Service Technician.

TABLE 2-2: Altitude Correction

Altitude Correction

Altitude (ft.)	Altitude Table (cm^3)
0 to 1,500	2.0
2,000 to 3,500	2.1 ± 0.1
4,000 to 6,000	2.2 ± 0.1
6,500 to 7,500	2.3 ± 0.1
8,000 to 9,000	2.4 ± 0.1
9,500 to 10,000	2.5 ± 0.1

The altitude calibration mode can only be entered when the TM 262 is powered up from its "off" state while the PROGRAM [PROG] mode button, is depressed. Hold the PROGRAM [PROG] button for approximately five seconds.

STEP 1

When entering the altitude mode the display will read as follows:

Altitude Mode
ECV 2.0
cm^3 9.99
Standard

(E71) is displayed in the bottom right corner of the display until the probe is in the 2.0 cm^3 cavity.

STEP 2

Place the probe into the 2.0 cm^3 cavity provided with the instrument and check cm^3 value against the altitude correction table for accuracy.

STEP 3

If the measured volume is not within the published table value ±0.1cc, then the operator should exit the altitude mode by pressing the PROGRAM [PROG] button and contact field service.

Providing the measured volume agrees with the published table ±0.1cc, the operator may proceed with the altitude adjustment.

STEP 4

With the probe still in the 2.0 cm^3 cavity, select the PAGE [PAGE] button to enter the custom calibration mode. Custom will appear on the fourth line of the display.

STEP 5

The value now displayed in the cm^3 display area is the volume measured and adjusted to the current altitude. If the value displayed is 2.0 cc, then the volume is adjusted to the current site. If the value is not 2.0 cc ±0.1, then press the SAVE [M+] button to customize the volume measurement to the current altitude. The measured volume should now read 2.0 cc.

STEP 6

To exit the altitude mode, press the PROGRAM [PROG] button to return to normal mode.

2.8 PRETEST AUDIOMETRIC CHECKS (Models with Audiometer Only)

2.8.1 Noise Recovery Period

Exposure to high levels of sound (e.g., unmuffled lawn mowers, loud music, gunfire) tends to create a Temporary Threshold Shift (TTS) which diminishes with time after exposure. Any subject tested soon after such exposure may exhibit a hearing loss that does not reflect his/her normal hearing threshold. This test procedure, therefore, generally prescribes a 16 hour interval between the last exposure to high-level sounds and the administration of any hearing test.

2.8.2 Elimination of Ambient Noise

Excessive noise in the test environment during audiometric testing, such as that produced by conversation, computers and public address systems reduces test validity because it tends to mask the test signals, particularly at the lower frequencies where earphone cushions provide less effective attenuation. An acoustically-treated room may be required if ambient noise reaches objectionable levels, i.e., sufficient to cause apparent hearing loss at the low frequencies. Also, earphone sound enclosures are available from Welch Allyn as an optional accessory. If the person being tested is in the same room as the audiometer, it is recommended that he/she be seated about three feet (one meter) away from the TM 262™ Auto Tymp™.

Maximum permissible noise levels are specified by the American National Standards Institute—Criteria for Permissible Background Noise during Audiometric Testing, ears covered with earphones (S3.1-1991 revised). Table 2-3 shows the maximum background levels that can be present inside the room while a valid hearing test is being conducted. For more comprehensive information about hearing testing and hearing conservation, refer to the Bibliography.

TABLE 2-3: Permissible Noise Levels

Test Tone Frequency (Hz)	125	250	500	750	1000	1500	2000	3000	4000	6000	8000
Test Room											
Ears covered maximum permissible octave band levels	34.0	22.5	19.5	21.5	26.5	26.5	28.0	33.5	34.5	38.0	43.5
Ears covered maximum permissible one-third octave band levels	29.0	17.5	14.5	16.5	21.5	21.5	23.0	28.5	29.5	33.0	38.5

2.9 BIOLOGICAL CHECK

To determine that your TM 262 is functioning properly, perform a daily check on a normal ear—your own if possible. This allows you to listen for the probe tone and the stimulus tone (during reflex) and determine if the air-pressure system is working properly. Keep a copy of your chart for a day-to-day reference in checking your TM 262.

If you purchased the TM 262™ Auto Tymp™ with audiometry, select the AUDIOMETRY [AUD] button located in the center section of the front panel. Note that the display changes to an audiogram format. The Hz [◄] and Hz [►] buttons allow you to select each frequency and the dB HL knob allows you to alter the intensity of each frequency. Position the test headset on your head so that each earphone is covering the appropriate ear (i.e., red is right and blue is left). Select the right earphone by pressing the front panel button labelled R and check for the following while depressing the present bar:

- Depressing the Hz [◄] button causes the frequency to change to a lower frequency, depressing the Hz [►] button causes the frequency to change to a higher frequency.
- Each frequency or tone is pure, i.e., there is no distortion or crackling sound present.
- Rotating the dB HL knob in a clockwise direction increases in intensity of the tone.
- Rotating the dB HL knob in a counter-clockwise direction decreases the intensity of the tone.

Specifications

STANDARDS:

IEC 601-1 Medical Electrical Equipment Requirements for Safety

CSA C22.2 No. 601-1-M90 Electromedical Equipment, Warnock Hersey Listed

ANSI S3.39-1987 Aural Acoustic Impedance Admittance (Type 3)

IEC 1027-1991 Aural Acoustic Impedance/Admittance (Type 3)

ANSI S3.6-1989 Audiometers (Type 4)

IEC 645-1 Pure Tone Audiometers (Type 4)

TYMPANOMETRY/REFLEX MODES:

Probe Tone: 226 Hz, ± 3%

Sound Pressure Level: 85.5 dB SPL, ± 2.0 dB, measured in a 2.0 cm^3 coupler

Harmonic Distortion: <5%

Admittance (Compliance) Range: 0 to 1.5 cm^3

0 to 3.0 cm^3

NOTE:

1. The range is automatically selected based upon the amplitude of the compensated (tymp only) tympanogram.
2. The maximum uncompensated (ECV + tympanogram peak) admittance (compliance) range is 0 to 5.0 cm^3.
3. ECV/cavity limits for initiating pressurization is 0.2 to 6.0 cm^3.

Compliance Accuracy: ± 0.1 cm^3 or ± 5%, whichever is greater

PNEUMATIC SYSTEM

Pressure Range: +200 to –400 daPa

NOTE:

1. 1 daPa = 1.02 mm H_20
2. Pressure sweeps to at least –100 daPa. To save test time, pressure sweep stops once tympanogram returns to baseline after –100 daPa.
3. Full pressure sweep for 6 cm^3 from sea level to 7000 ft. altitude with no leak.

Pressure Accuracy: ±10 daPa or ±15%, whichever is greater

Rate of Sweep: 600 daPa/sec except near tympanogram peak where sweep rate slows to 200 daPa/sec to provide better definition of peak compliance.

Direction of Sweep: Positive to negative

Tympanometric Test Time: approximately one second

NOTE:
High compliance tympanograms will take somewhat longer

Gradient: Tympanogram pressure width at 50% of peak compliance.

ACOUSTIC REFLEX STIMULI:

Frequencies: 500, 1000, 2000, and 4000 Hz

Accuracy: ±3%

Total Harmonic Distortion: <5%

Rise/Fall Time: 5 to 10 msec

Output Levels:

IPSI: 500 and 4000 Hz:80, 90, 100 dB HL

1000 and 2000 Hz: 85, 95, 105 dB HL

NOTE:

1. Ipsi stimuli are time multiplexed with probe tone (106 msec ON, 53 msec OFF).
2. Stimuli are presented at lowest level first. If there is no response, the intensity is increased by 10 dB until a response is detected or the maximum dB HL is reached.

Pressure: Automatically set to pressure at peak compliance with an offset of –20 daPa.

Reflex Determination: Compliance change of 0.05 cm^3 or greater.

Reflex Test Time: 1 to 12 seconds depending upon the number of ipsi test frequencies selected (four maximum) and intensity required.

Probe LED Indicators:

Steady yellow: occlusion

Blinking green: ready to start testing

Steady green: test in progress

Steady orange: leak

AUDIOMETRY MODE (Model No. 26230, No. 26230-RS, No. 26235 and No. 26235-RS only— marked "Version 4")

Frequencies: 125, 250, 500, 750, 1000, 1500, 2000, 3000, 4000, 6000, 8000 Hz

Accuracy: ± 3%

Total Harmonic Distortion: < 3% (125 to 3000 Hz measured acoustically at maximum dB HL; 4000 & 6000 Hz measured electrically)

Intensity Levels: 125 Hz: –10 to 50 dB HL

500 to 6000 Hz: –10 to 90 dB HL

250 and 8000 Hz: –10 to 70 dB HL

NOTE:
An additional +10 dB is available per frequency via the +10 dB button.

Accuracy: 125 to 4000 Hz ±3 dB

6000 and 8000 Hz ±5 dB

Step Size: 5 dB

Signal-to-Noise Ratio: > 70 dB in 1/3 octave; less than –10 dB HL for levels less than 60 dB HL

Rise/Fall Time: 20 to 50 msec

Tone Format (tone is normally off until present bar is depressed):

Continuous: steady when present bar is depressed

Pulsed: 2.5/sec (i.e., 200 msec ON, 200 msec OFF)

FM (frequency modulated): 5 Hz, ±5%

TRANSDUCERS

IPSI: Welch Allyn design

Audiometric Headset: Pair TDH-39 earphones with MX41AR cushions (60 ohms impedance)—Models No. 26230, No. 26230-RS, No. 26235 and No. 26235-RS only (marked "Version 4")

PRINTER

Paper Roll Length: approximately 80 feet (960")

Tests/Roll: Tymp and Reflex = 420 tests or 210 people

Tymp and Reflex plus one audiogram = 230 tests or 115 people

Speed: approximately 1.5 minutes to print three screens (including audiogram).

POWER

Line Voltage: 120 V (±10%) or 220 V (±10%) or 240 V (±10%)

NOTE:
Wall mount power supply or internal power supply depending upon country.

Frequency Range: 50 to 60 Hz (±5%)

Line Voltage Current: 0.2 amps at 120 V or 0.1 amps at 240 V AC

Power Consumption: 15 watts maximum while printing.
Low voltage input for wall mount power supplies 10 to 11 VDC 970 mA.

ENVIRONMENTAL

Temperature:

Operating:	60° F to 105° F	Storage:	–40° F to 140° F
	15° C to 40° C		–40° C to 60° C

NOTE:
Warm-up time is required if storage temperature is different from room temperature.

Humidity: 5% to 90%

MECHANICAL

Dimensions: 13.15" W x 14.5" D x 4.3" H
33.66 cm W x 35.56 cm D x 9.53 cm H

Weight: 10 lbs (4.5 kg) net
14 lbs (6.4 kg) shipping

SUPPLIED ACCESSORIES	CATALOG NUMBERS
Instruction Manual	#1738-0101
TDH-39 Headset (Models #26230/#26235 Only)	#23223
Test Cavity	#26241
Eartips (6 sizes, 2 each)	#26100
Paper — 3 rolls thermal 4" (10.16 cm wide)	

CALIBRATION

EQUIPMENT REQUIRED FOR CALIBRATION

TYPE 1 SOUND LEVEL METER

ARTIFICIAL EAR

2 cc COUPLER (GSI #1700-2005 OR B&K #DB0138)

9A (6 cc) COUPLER OR B&K ARTIFICIAL EAR (B&K #4153)

MANOMETER

VOLTMETER (RMS)

FREQUENCY COUNTER

1700-l 030 TEST CAVITY

SMALL STANDARD (SLOTTED) SCREWDRIVER

SMALL PHILLIPS (CROSS) SCREWDRIVER

CALIBRATION PROCEDURE

CONFIG. REGISTER: During routine Calibration it is not necessary to program the Config. Register. Programming the Config. Register establishes the microprocessors mode of operation and once programmed should never change. If a new microprocessor is installed in location XU7 or XU34 its Config. Register must be programmed. To program the Config. Register install temporary jumpers (shorts) on JP1 and JP3 then power up the unit. Almost immediately after power up the unit will display Config. Register Programmed. At this point power down and remove the previously installed jumpers. The Config. Register is now programmed.

DEFAULT DATA LOADING: Durina routine calibration it is not necessary to load Default Data. Defautt Data Loading allows the technician to quickly store an averaged set of calibration values into EEPROM. Also, if a new microprocessor has been installed the Default Data loads critical power-up information that the processor requires for operation into EEPROM. When a new microprocessor or Auto/Tymp Board is installed Default Data should be loaded. Load Default Data by setting Dip Switch positions 6, 7, and 8 to the "ON" position. Set the Cal/Norm Switch to the Cal Mode, then power up the unit. At power-up the display should indicate the unit model and version number (GSI 38 Version X), the Tymp/Reflex Software Revision Number (Tymp/Reflex Rev XXX), the Audiometer Software Revision Number (Audiometer Rev XXX), and the Default Parameters which are currently being loaded into EEPROM (Loading Audiometer Defautts, Loading Programmed Defautts, or Loading Tymp/Reflex Defaults). When the Default Data Loading sequence is complete the display will update to the Main Calibration Mode Menu. At this point Dip Switches 6, 7, and 8 should be returned to their normally OFF position.

The technician may also load an individual set of Default Data by first setting the desired Dip Switch to the ON position then setting the Cal/Norm Switch to the Cal Mode position. Dip Switch assignments are as follows:

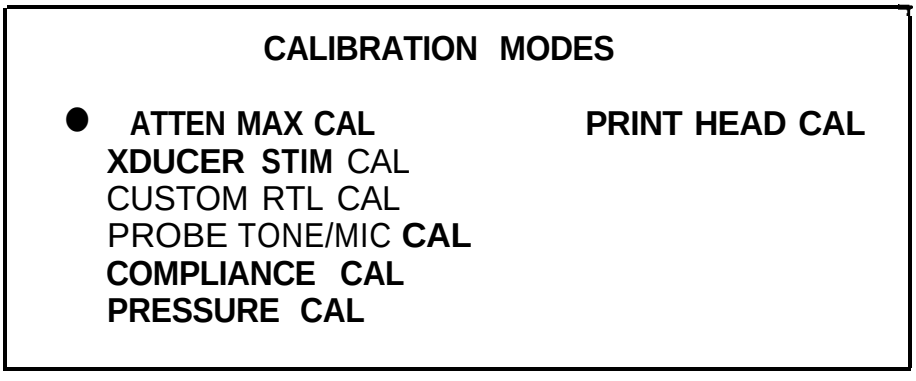
Dip Switch	Function	Location Loaded
6	Tymp/Reflex Defaults	Tymp EEPROM
7	Audiometer Defaults	Audio EEPROM
8	Programmed Defaults	Audio EEPROM

ENTERING THE CALIBRATION MODE DIRECTLY (ROUTINE CALIBRATION)

1) Verify that Dip Switches 6, 7, and 8 are in the OFF position.

2) Power up the unit.

3) Slide the Cal/Normal Switch to the Cal Mode position. The display should appear as follows:



AUDIOMETER CALIBRATION

ATTENUATOR MAXIMUM OUTPUT CALIBRATION: During routine calibration it should not be necessary to calibrate the Attenuator Maximum Output. However, if **the Audiometer Default Data has been loaded then the Attenuator Maximum Output must be calibrated.**

1) Connect the right phone output unloaded to an RMS Meter.

2) Use the ◄ Hz ► Keys to position the cursor on the 38 display at the ATTEN MAX CAL position.

3) Press the PROG Key to enter the ATTEN MAX CAL Mode.

4) Press the Present Bar ▭ to lock on the tone.
(The Tone Indicator 🔊 should now be present on the display.

5) Use the ◄ Hz ► to select the desired frequency for calibration. Adjust the dB HL knob until the output level for currently display frequency is within the minimum/maximum values listed in the following table. When the desired output level has been reached store the value by pressing the M+ **Key. Repeat** for all frequencies.

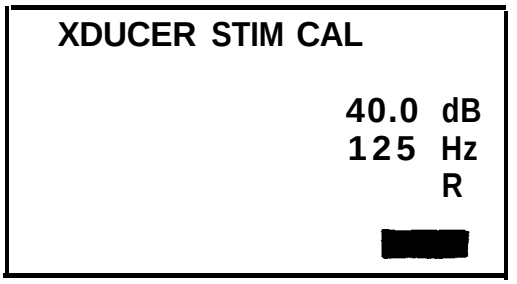
Frequency (Hz)	Minimum - Maximum
125	**2.05 - 2.30 vrms**
250	**2.05 - 2.30 vrms**
500	**2.33 - 2.5 vrms**
750	1.69 - 1.9 vrms
1000	2.28 - 2.5 vrms
1500	2.28 - 2.5 vrms
2000	2.55 - 2.70 vrrns
3000	2.28 - 2.50 vrms
4000	2.55 - 2.70 vrms
6000	2.28 - 2.50 vrms
8000	2.28 - 2.50 vrms

After all frequencies have been calibrated press the PROG Key to the Main Calibration Mode Menu.

AUDIOMETER SPL OUTPUT LEVEL CALIBRATION

1) Use the ◄ Hz ► Keys to position the cursor on the **38** display at XDUCER STIM CAL.

2) Press **the** PROG **Key to** enter the **XDUCER STIM CAL MODE.**
The display should now indicate:



NOTE: Tone Bar is OFF **or Inactive**

40.0 dB	Indicates the Current Hearing Level (HL) selected.
125 Hz	Indicates the Current Frequency (Hz) selected.
R	Indicates the Current Transducer selected.
▬▬	Indicates a Steady Tone Presentation

The Tone Bar is active in this mode and serves a dual function. When the Tone Bar is OFF or inactive the current hearing level is displayed as shown above.

When the Tone Bar is pressed ON or active the stim on indicator will appear on the display and the 40.0 dB (HL) indicator will update to the ANSI Standard Reference Threshold Level (RTL) measured in Sound Pressure Level (SPL) for the selected frequency and hearing level.

Example: 40.0 dB (HL) at 125 Hz (Freq) will update to 85.0 dB SPL when the Tone Bar is depressed.

Given: The ANSI Standard (RTL) correction value for 125 Hz at 0 HL is equal to 45.0 dB SPL.

Therefore: At 40 dB HL which **is** 40 dB SPL higher that 0 dB HL the output for 125 **Hz** will equal 85.0 dB SPL.

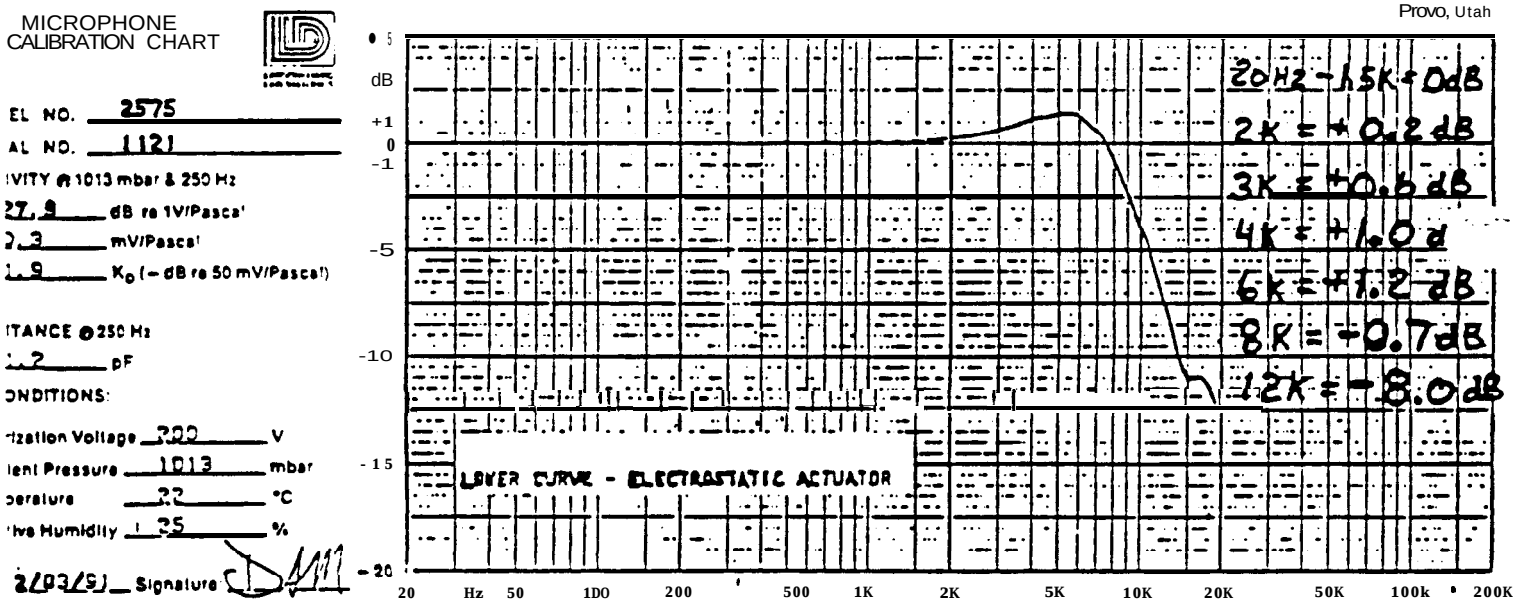
For 125 Hz

ANSI Standard RTL for 0 dB HL	45.0 dB SPL
(+)40 dB HL =	(+)40.0 dB SPL
40 dB HL =	85.0 dB SPL

For 8 KHz

ANSI Standard RTL for 0. dB HL =	13.0 dB SPL
(+)60 dB HL =	(+) 60.0 dB SPL
60. dB HL =	73.0 dB SPL

When calibrating using a Sound Level Meter (SLM) it is important to add or subtract the appropriate microphone correction. When the microphones are calibrated the manufacturer or calibration facility should supply the microphone's frequency response curve. The microphone is then calibrated to the SLM which has a flat frequency response by using a piston phone or similar standard device. Below is an example of a microphone frequency response curve.



The curve shows that the microphone response is flat between 20 Hz and 1.5 KHz, high between 2 KHz and 6 KHz, and low at frequencies 8 KHz or greater. Using 4 KHz **as** an example when a standard force is applied to the surface of this microphone its output is 1 dB high. Therefore, when calibrating 4 KHz using this microphone we must add 1 dB to our expected value. Our formula for determining the proper calibration level for 4 KHz is as follows:

4 KHz ANSI Standard RTL for	0. dB HL =	9.5 dB SPL
Reference HL for Calibration	(+)80. dB HL =	(+)80.0 dB SPL
(+) or (-) Microphone Correction	NA.	(+) 1.0 dB SPL
	80. dB HL =	90.5 dB SPL

The following table contains the ANSI Standard Reference Threshold Levels RTL's at 0 HL for each frequency when using TDH-39P earphones.

Frequency (Hz)	125	250	500	750	1000	1500	2000	3000	4000	6000	8000
ANSI Standard **RTL** **Measured in dB SPL**	45.0	25.5	11.5	7.5	7.0	6.5	9.0	10.0	0.5	15.5	13.0

Standard Reference Threshold Levels re: 20 μPa for Telephonics TDH-39P earphones as measured on the National Bureau of Standards 9-A coupler. Reference ANSI S3.6 - 1989, ISO 389 - 1975 Standards.

Grason-Stadler has made an effort to minimize calibration time by defaulting the Reference HL Levels for Calibration to maintain an expected SPL Calibration Level of between 85 and 95 dB SPL. The Default HL Levels are as follows:

Frequency (Hz)	125	250	500	750	1000	1500	2000	3000	4000	6000	8000
Default HL	40	60	80	80	80	80	80	80	80	80	60

Because the 38 automatically adds the ANSI RTL and reference HL values on the display (when the Tone Bar, is active) the technician needs only to add or subtract the appropriate microphone correction to the displayed value when calibrating.

3) Connect the right ear phone to the Sound Level Meter Artificial Ear.

4) Press (TONE BAR) the display will update from the selected hearing level to the ANSI Standard RTL value for calibration and the indicator will appear).

5) Adjust the HL knob until the SPL Level measured on the SLM for the selected frequency and transducer equals the value indicated on the 38 display (+ or - Microphone Correction).

6) Press the [M+] Key to store the data in memory.

7) Repeat for all frequencies, right phone, left phone, ipsi and contra by selecting the appropriate key on the 38 front panel.
NOTE: Both left phone and right phone must be calibrated.

8) When finished press the [PROG] Key to return to the Main Calibration Mode Menu.

CUSTOM RTL CAL

This mode is used primarily if a customer wants to calibrate using transducers other than TDH-39P earphones. This mode allows the technician to program different RTL values to be displayed when calibrating using the XDUCER STIM CAL MODE. Once programmed, the Custom RTL values will be displayed each time the XDUCER STIM CAL MODE is entered. The range of allowable RTL's is -5 dB to 63.5 dB A # sign will appear next to the dB HL indicator on the display when Audiometry Mode is selected to indicate to the customer that Custom RTL values have been programmed. To return to the ANSI Standard Values and extinguish the # sign, the technician must load Audiometry Default Calibration Data.

1) Use the ◄ Hz ► Keys to position the cursor at Custom RTL Cal on the display.

2) Press the PROG Key to enter the Custom RTL Cal Mode.

3) Press the ◄ Hz ► Keys to select the desired frequency.

4) Adjust the dB HL dial to achieve the desired RTL value.

5) Store the value into memory by pressing the M+ Key.

6) Repeat for all desired frequencies.

7) Press the PROG Key to return to the Main Calibration Menu.

NOTE: Adjusting the Custom RTL values has no effect on the earphone output level. After storing the Custom RTL's the technician must calibrate to the appropriate levels using the XDUCER STIM CAL MODE.

PROBE TONE/MIC CAL

1) Use the ◄ Hz ► Key to position the cursor at the Probe Tone/Mic Cal Mode position.

2) Press the PROG Key to enter Probe Tone/Mic Cal Mode. The display will update to the following "flashing" display.

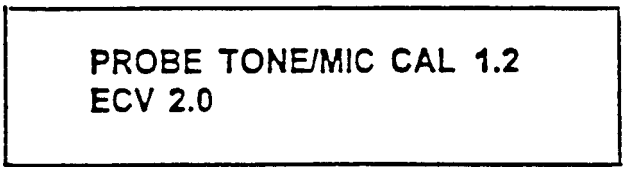
PROBE TONE/MIC CAL **1.1** **ECV** SLM

At this point place the probe in the 2 cc coupler on the Sound Level Meter.

3) Press the [M+] Key and the display will stop flashing.

4) Use the dB HL dial to adjust the Probe Tone Level to 85.5 dB SPL (+/- 0.9 dB). At this point the Probe Tone Frequency may be verified. It should equal 226 Hz (+/- 6 Hz).

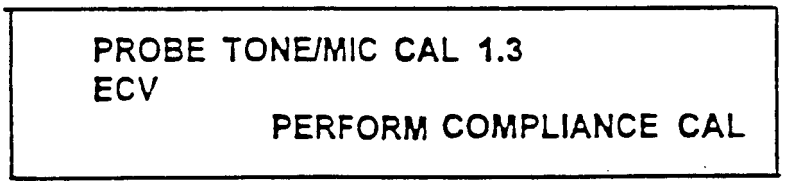
5) Press the [M+] Key to store the data in memory. The display will update to the following 'Washing" display.



At this point place the probe in the 2 cc test cavity.

6) Press the [M+] Key to start the microphone calibration process. The display will update to the following steady state display.

After a few seconds the SAVED indicator will extinguish and the 1.2 indicator will change to 1.3. When the cycle is complete the display will update to the following "flashing" display.



7) Press the [PROG] Key to return to the Main Calibration Mode Menu.

COMPLIANCE CAL

1) Use the [◄] Hz [►] Keys to position the cursor at the Compliance Cal Mode position.

2) Press the [PROG] Key to enter the Compliance Cal Model The display will update to the following "flashing" display.

```
COMPLIANCE CAL 2.1
ECV 0.5
cm3
```

3) Place the probe into the 0.5 cc calibration cavity then press the [M+] Key to start the 0.5 cc calibration. The display will stop flashing and remain in steady state to indicate that calibration is in progress.

NOTE: If the wrong cavity size is used the display will indicate E74 in the lower right hand corner. After approximately 5 seconds the ERROR MESSAGE will extinguish and the calibration process may be continued by placing the probe into 0.5 cc cavity and then pressing the [M+] Key.

When the 0.5 cc calibration is complete the display will update to the following "flashing" display.

```
COMPLIANCE CAL 2.2
ECV 2.0
cm3
```

At this point place the probe into the 2.0 cc test cavity.

4) Press the [M+] Key to start the 2.0 cc calibration. The display will stop flashing and remain in steady state to indicate that calibration is in progress.

NOTE: If the wrong cavity size is used the display will indicate E74 in the lower right hand corner. After approximately 5 seconds the ERROR MESSAGE extinguish and the calibration process may be continued by placing the probe into the 2.0 cc cavity and then pressing the [M+] Key.

When the 2.0 cc calibration process is complete the display will update to the following steady state display.

```
COMPLIANCE CAL 2.3
ECV 2.0
cm3 X.XX
```

X.XX is equal to the current volume measurement.

The calibration of compliance measuring devices is affected by air density. As the air gets thinner, the volume measurement in a hardwall cavity increases. Therefore, as you go up in altitude, barometric pressure decreases making the hardwall cavity appear larger than it is. The GSI 38 allows the flexibility to display the real altitude effect or to correct the ear canal measurements relative to sea level.

A) If the customer prefers to correct the ear canal volumes relative to sea level then adjust the [◄] Hz [►] Keys until the cm3 XXX value equals 2.00 (±.1). After adjusting to the desired level store the value by pressing the [+M] Key. The display will start "flashing" indicating that the compliance calibration process is complete.

B) If the customer prefers uncorrected ear canal volumes (actual at altitude measurements) then adjust the [◄] Hz [►] Keys until the cm' XXX value indicates the appropriate volume measurement for the customer site elevation according to the following altitude table.

Altitude (ft)	Barometric Pressure (mm Hg)	Expected Volume Reading at Altitude (cc)	Calibration Volume at Altitude (cc)
0	759.97	2.00	2.0±0.1
500	746.51	2.01	2.0±0.1
1000	733.04	2.03	2.0±0.1
1500	719.84	2.05	2.0±0.1
2000	706.63	2.07	2.1±0.1
2500	693.93	2.09	2.1±0.1
3000	681.23	2.11	2.1±0.1
3500	668.78	2.13	2.1±0.1
4000	656.34	2.15	2.2±0.1
4500	644.40	2.17	2.2±0.1
5000	632.46	2.20	2.2±0.1
5500	620.78	2.22	2.2±0.1
6000	609.09	2.25	2.2±0.1
6500	598.00	2.27	2.3±0.1
7000	588.00	2.30	2.3±0.1
7500	578.00	2.34	2.3±0.1
8000	568.00	2.37	2.4±0.1
8500	555.00	2.40	2.4±0.1
9000	544.00	2.44	2.4±0.1
9500	533.00	2.49	2.5±0.1
10000	522.00	2.54	2.5±0.1

Press the [M+] Key to store the customer altitude volume measurement. The display will start "flashing" indicating that the Compliance Calibration process is complete.

5) Press the [PROG] Key to return to the Main Calibration Mode Menu.

PRESSURE CAL

1) Use the [◄] Hz [►] Keys to position the cursor at the Pressure Cal position.

2) Press the [PROG] Key to enter the Pressure Cal Mode. The display will update to the following "flashing" display.

```
'PRESSURE CAL        3.1
 ECV OPEN
 A/D
 daPa
```

At this point make sure that the probe tip is in open air.

3) Press [M+] Key to start the Ambient Pressure Calibration. When the Ambient Pressure Calibration is complete the display will update to the following "flashing" display.

```
PRESSURE CAL         3.2
ECV MANOMETER
A/D XXXX
daPa -200
```

At this point connect the probe tip to a manometer.
NOTE: Manometer internal volume must be less than 5 cc's.

4) Press the [PAGE] Key. At this point the pump will pressurize to -200 daPa

5) Use the [◄] Hz [►] Keys to adjust the pressure on the external manometer to -200 daPa (±15%)

6) Press the [M+] Key to store the -200 daPa Calibration data. The messages saved will appear in the lower right hand corner of the display. After 3 to 5 seconds the saved indicator will be extinguished and the display will update to a steady state display as follows.

At this point verify that the leak rate is less than 2 daPa/sec:

7) Press the [PAGE] Key and the 38 will pressurize to +200 daPa. manometer reading is within (±15%) of the pressure value indicated on the 38 display.

8) Press the [PROG] Key to return to the Main Calibration Mode Menu.

PRINT HEAD CAL

1) Use the [◄] Hz [►] Keys to move the cursor at the Print Head Cal position.

2) Press the [PROG] Key to enter the Print Head Cal Mode.

3) Press the [◄] Hz to lighten the printout and the [►] Hz Key to darken the printout. When either key is pressed the printer will print a test pattern (the alphabet) on a single line. When the center of the adjustment range is crossed the In Range indicator on the display will appear (when adjusting from a light intensity to a dark intensity) or extinguish (when adjusting from a dark intensity to a light intensity).

EXAMPLE OF PRINT INTENSITY ADJUST RANGE.
TOTAL RANGE = 20 STEPS OR 20 DIFFERENT INTENSITY LEVELS.

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z :
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z :
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z :
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z :
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z :
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z :
A B C D E F G H I J K L R N O P Q R S T U V W X Y Z :
A B C D E F G H I J K L R N O P Q R S T U V W X Y Z :
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z :
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z :
● A B C D E F G H I J K L N N O P Q R S T U V W X Y Z :
● A B C D E F G H I J K L M N O P Q R S T U V W X Y Z :
● A B C D E F G H I J K L M H O P Q R S T U V W X Y Z :
• A B C D E F G H I J K L M N O P Q R S T U V W X Y Z ;
● A B C D E F G H I J K L M N O P Q R S T U V W X Y Z :
● A B C D E F G H I J K L M N O P Q R S T U V W X Y Z :
● A B C D E F G H I J K L M N O P Q R S T U V W X Y Z :
● A B C D E F G H I J K L M N O P Q R S T U V W X Y Z :
● A B C D E F G H I J K L M N O P Q R S T U V W X Y Z :
● A B C D E F G H I J K L M N O P Q R S T U V W X Y Z :

• "In Range" indicated on display.

4) Press the [M+] Key to store the desired intensity value.

5) Press the [PROG] Key to return to the Main Cal Mode Menu.

6) Slide the Cal/Norm Switch to Norm to return to Normal Mode Operation.

S4 DIP SWITCHES.		
	O N	OFF
S1	Unused	Unused
S2	Factory Auto Cal	Norma! Cal Mode Operation
S3	To Be Defined	Normal Cal Mode Operation
S4	To Be Defined	Normal Cal Mode Operation
S5	To Be Defined	Normal Cal Mode Operation
S6	Tymp/Reflex Default Data	Normal Cal Mode Operation
S7	Audiometer Default Data	Normal Cal Mode Operation
S8	Program Default Data	Normal Cal Mode Operation

TROUBLE SHOOTING

ERROR MESSAGES (EXX)

NOTE: If an Error Message is observed the associated code number should be recorded for future reference. The Error Code Number is designed to point to a specific block of circuitry which will enable the technician to repair the problem in a fast, efficient manner. Most software errors are related to poor environmental conditions such as static electricity and power line interference and will generally clear with power down/up. Contact your local sales and service organization and supply them with the Error Code Number if the error will not clear with power down/up.

AUDIOMETER PROCESSOR RELATED MESSAGES

Code Number	Description/Possible Cause
01	EPROM Checksum Error on power up / if non-recoverable possible defective Auto/Tymp Board EPROM U30 or Microprocessor U34.
02	Microprocessor Internal RAM Error on power up / if non-recoverable replace Microprocessor U34.
03	Watch Dog Timer Timeout / the Watch Dog Timer Circuit monitors the Microprocessor's operation. The Processor must periodically send an "I'm Okay" message 'to the watch dog or the watch dog will halt all operations. If non-recoverable try replacing. Microprocessor U34 or Audiomymp Board.
04	Microprocessor Clock Failure / if non-recoverable possible defective crystal Y2 or Microprocessor U34.
05	Undefined Interrupt Error / this type of soft error should always be recoverable. It relates to an Interrupt that the Processor does not acknowledge or cannot execute. If non-recoverable replace Audiomymp Board.
06	Opcode Trap Interrupt Error /this type of error code should always be recoverable. If non-recoverable replace Microprocessor U34 or Audiomymp Board.
07	External RAM Error / if non-recoverable possible defective Audio RAM U32 or Microprocessor U34.
08	Normal or Swap Stack Overflow into the Global Variables / should always be recoverable. If non-recoverable replace Audio/Tymp Board.

Code Number	Description/Probable Cause
09	Conf. Register Error / if non-recoverable re-calibrate Config, Register then replace Microprocessor U34.
10	Halt in Response to Remote Command / if non-recoverable possible defective Audio/Tymp Communications Chip U36 or Microprocessor U34.
11	Invalid Keycode detected in CMDTSK / if non-recoverable possible defective Switch Panel, Switch Buffer U26, U27, or U28, or Microprocessor U34.
12	Invalid Keysource detected in CMDTSK / same as above.
'13	Invalid Queue Power Error detected in CMDTSK /same as above.
'14	Bad Pointer to EEPROM Routine'/
'15	Collision of the Normal Stack and Swap Stack /
'16	Invalid function for a Banded Swapped Function /
'17	Printer RAM Error on power up / internal or micro
'18	Tymp Hardware State is unknown /
'19	Non-Fatal Audiometer related error messages
'20	Calibration Data Read Error occured /
'21	HL Limit exceeded /
22	Invalid Extended Range Selection due to HL not in range where the Extend Range is valid /
23	Calibration Data Write Error occurred /
24	Invalid Present Bar Operation due to a Calibration Data Error /

Code Number	Description/Probable Cause
25	Remote Record received with a Bad Record Format, invalid Key Code, or Invalid Record Type /
26	EEPROM Checksum Error /
27	EPROM TO EEPROM Data Load Error /
28	Remote Command received from an external remote device (factory auto cal) which is invalid due to mode or is an unsupported record type /
29	Remote command received from an external remote device (factory auto cal) which is ignored due to mode /
30	GSI vs Custom RTL Calibration status Read Error from EEPROM /
31	Printer Calibration Data Read Error /
32	No test available to print /
33	Tymp/Reflex Processor not responding to a command from the Audio Processor or the Tymp/Reflex Processor is not setting the Synch ___ Stimo line on power up /
34	No Free Memory available when going to a new test /
35	Invalid test type read from memory when trying to display
36	Print Head initialization failed /
37	Printer Ambient temperature out of Range /
38	Record was received from the Tymp/Reflex Processor which has a valid format but the record type was not the type expected /
39	Call Factory for instruction
40	Audiometry mode not enabled

TYMP PROCESSOR RELATED MESSAGES

Code Number	Description/Probable Cause
51	EPROM Checksum Error on power up /
52	Internal RAM Error on power up /
53	Watch Dog Timer Time Out /
54	CPU Clock Failure /
55	Undefined Interrupt Error /
56	Opcode Trap Interrupt Error /
57	External RAM Error /
58	Stack Overflow Error /
59	Config. Register Error /
60	Bad Pointer to EEPROM Routine /
61	EEPROM Read Error in Norm or Alt Mode /
62	Couldn't Home Pump /
63-69	Undefined Non Fatal Errors
70	Probe is occluded or in cavity at power up /
71	Probe not in 2.0 mL cavity during Altitude Adjustment Cal Mode
72	End of gain reached in Microphone Cal Mode /
73	Probe Tone Gain Error during Probe Tone Gain Verification /
74	Cavity Error during Calibration /
75	Compliance Calibration Error /
76	Unused

Code Number	Description/Probable Cause
77	A/D Pressure Value out of range of Pressure Transducer Gain Error /
78	Remote Record Error /
79	Non-Fatal Cal Data Read/Write Error /
80	Reflex Test info not received for the Audio within the allotted time /
81	Remote Command invalid for the mode /
82	Leak or Occlusion Error /
83	Pump end of stroke /
84	Undefined Error Number Reported /